CLAIMS

1. An article comprising a free-standing and bulk-doped semiconductor comprising at least one portion having a smallest width of less than 500 nanometers.

2. The article of claim 1, wherein the at least one portion has a maximum width of less than 500 nm.

3. The article of claim 1, comprising:

   a core comprising a first semiconductor; and

   at least one shell surrounding at least a portion of the core, the at least one shell comprising a different material than the first semiconductor.

4. The article of claim 3, wherein the shell comprises a semiconductor.

5. The article of claim 3, wherein the at least one shell comprises a functional moiety.

6. The article of claim 3, wherein the at least one shell comprises an oxide.

7. The article of claim 6, wherein the oxide is amorphous.

8. The article of claim 3, wherein the functional moiety is light-activatable.

9. The article of claim 3, wherein the at least one shell consists essentially of a functional moiety.

10. The article of claim 3, wherein the at least one shell comprises a reaction entity.

11. The article of claim 3, wherein the at least one shell is an atomic monolayer.

12. The article of claim 3, wherein the at least one shell is delta-doped.

13. The article of claim 3, wherein the at least one shell comprises a first shell and a second shell of different composition.

14. The article of claim 13, wherein the first shell surrounds at least a portion of the second shell.

15. The article of claim 13, wherein at least a portion of the first shell and at least a portion of the second shell are co-radial.

16. The article of claim 13, wherein the article has a longitudinal axis, the first shell positioned longitudinally of the second shell.

17. The article of claim 3, wherein the at least one shell is an inductive shell.

18. The article of claim 3, wherein the core is able to induce a change in the at least one shell.

19. The article of claim 3, wherein the at least one shell is polarizable.

20. The article of claim 3, wherein the at least one shell is ferromagnetic.

21. The article of claim 3, wherein the at least one shell is mechanically inducible.

22. The article of claim 3, wherein the at least one shell is oxidizable.

23. The article of claim 3, wherein the at least one shell is reducible.

24. The article of claim 3, wherein the at least one shell is photoactivatable.

25. The article of claim 3, wherein the at least one shell has a thickness of less than about 5 nm.

26. The article of claim 3, wherein the at least one shell has a thickness of less than about 3 nm.

27. The article of claim 3, wherein the at least one shell has a thickness of less than about 1 nm.

28. The article of claim 1, wherein the article is able to bind to an analyte.

29. The article of claim 1, wherein the article comprises a reaction entity.

30. The article of claim 1, wherein the shell comprises a reaction entity.

31. The article of claim 29, wherein the reaction entity is selected from the group consisting of a nucleic acid, an antibody, a sugar, a carbohydrate, and a protein.

32. The article of claim 29, wherein the reaction entity comprises a catalyst.

33. The article of claim 1, wherein the semiconductor comprises an elemental semiconductor.

34. The article of claim 33, wherein the elemental semiconductor is selected from a group consisting of: Si, Ge, Sn, Se, Te, B, Diamond and P.

35. The article of claim 1, wherein the semiconductor comprises a solid solution of elemental semiconductors.

36. The article of claim 35, wherein the solid solution is selected from a group consisting of: B-C, B-P(BP_6), B-Si, Si-C, Si-Ge, Si-Sn and Ge-Sn.

37. The article of claim 1, wherein the semiconductor comprises a Group IV-Group IV semiconductor.

38. The article of claim 37, wherein the Group IV-Group IV semiconductor is SiC.

39. The article of claim 1, wherein the semiconductor comprises a Group III-Group V semiconductor.

40. The article of claim 39, wherein the Group III-Group V semiconductor is selected from a group consisting of: BN/BP/BAs, AlN/AlP/AlAs/AlSb, GaN/GaP/GaAs/GaSb, InN/InP/InAs/InSb.

41. The article of claim 1, wherein the semiconductor comprises an alloy comprising a combination of two or more Group III-Group V semiconductors from a group consisting of: BN/BP/BAs, AlN/AlP/AlAs/AlSb, GaN/GaP/GaAs/GaSb, InN/InP/InAs/InSb.

42. The article of claim 1, wherein the semiconductor comprises a Group II-Group VI semiconductor.

43. The article of claim 42, wherein the semiconductor is selected from a group consisting of: ZnO/ZnS/ZnSe/ZnTe, CdS/CdSe/CdTe, HgS/HgSe/HgTe, BeS/BeSe/BeTe/MgS/MgSe.

44. The article of claim 1, wherein the semiconductor comprises an alloy comprising a combination of two or more Group II-Group VI semiconductors from a group consisting of: ZnO/ZnS/ZnSe/ZnTe, CdS/CdSe/CdTe, HgS/HgSe/HgTe, BeS/BeSe/BeTe/MgS/MgSe.

45. The article of claim 1, wherein the semiconductor comprises an alloy comprising a combination of a Group II-Group VI semiconductors from a group consisting of: ZnO/ZnS/ZnSe/ZnTe, CdS/CdSe/CdTe, HgS/HgSe/HgTe,

BeS/BeSe/BeTe/MgS/MgSe and a Group III-Group V semiconductors from a group consisting of: BN/BP/BAs, AlN/AlP/AlAs/AlSb, GaN/GaP/GaAs/GaSb, InN/InP/InAs/InSb.

46. The article of claim 1, wherein the semiconductor comprises a Group IV-Group VI semiconductor.

47. The article of claim 46, wherein the semiconductor is selected from a group consisting of: GeS, GeSe, GeTe, SnS, SnSe, SnTe, PbO, PbS, PbSe, PbTe

48. The article of claim 1, wherein the semiconductor comprises a Group I-Group VII semiconductor.

49. The article of claim 48, wherein the semiconductor is selected from a group consisting of: CuF, CuCl, CuBr, CuI, AgF, AgCl, AgBr, AgI.

50. The article of claim 1, wherein the semiconductor comprises a semiconductor selected from a group consisting of: $BeSiN_2$, CaCN2, $ZnGeP_2$, $CdSnAs_2$, $ZnSnSb_2$, $CuGeP_3$, $CuSi_2P_3$, (Cu, Ag)(Al, Ga, In, Tl, Fe)$(S, Se, Te)_2$, Si_3N_4, Ge_3N_4, Al_2O_3, $(Al, Ga, In)_2(S, Se, Te)_3$ and Al_2CO.

51. The article of claim 1, wherein the semiconductor comprises a p-type dopant.

52. The article of claim 1, wherein the semiconductor comprises an n-type dopant.

53. The article of claim 1, wherein the semiconductor comprises a p-type dopant from Group III of the periodic table.

54. The article of claim 1, wherein the semiconductor comprises an n-type dopant from Group V of the periodic table.

55. The article of claim 1, wherein the semiconductor comprises a p-type dopant selected from a group consisting of: B, Al and In.

56. The article of claim 1, wherein the semiconductor comprises an n-type dopant selected from a group consisting of P, As and Sb.

57. The article of claim 1, wherein the semiconductor comprises a p-type dopant from Group II of the periodic table.

58. The article of claim 51, wherein the p-type dopant is selected from a group consisting of Mg, Zn, Cd and Hg.

59. The article of claim 1, wherein the semiconductor comprises a p-type dopant from Group IV of the periodic table.

60. The article of claim 51, wherein the p-type dopant is selected from a group consisting of C and Si.

61. The article of claim 52, wherein the n-type is selected from a group consisting of Si, Ge, Sn, S, Se and Te.

62. The article of claim 1, wherein the smallest width is less than 200 nanometers.

63. The article of claim 1, wherein the smallest width is less than 150 nanometers.

64. The article of claim 1, wherein the smallest width is less than 100 nanometers.

65. The article of claim 1, wherein the smallest width is less than 80 nanometers.

66. The article of claim 1, wherein the smallest width is less than 70 nanometers.

67. The article of claim 1, wherein the smallest width is less than 60 nanometers.

68. The article of claim 1, wherein the smallest width is less than 40 nanometers.

69. The article of claim 1, wherein the smallest width is less than 20 nanometers.

70. The article of claim 1, wherein the smallest width is less than 10 nanometers

71. The article of claim 1, wherein the smallest width is less than 5 nanometers

72. The article of claim 1, wherein the semiconductor is elongated, and the at least one portion is a longitudinal section.

73. The article of claim 72, wherein the longitudinal section, a ratio of the length of the section to a longest width is greater than 4:1.

74. The article of claim 72, wherein the longitudinal section, a ratio of the length of the section to a longest width is greater than 10:1.

75. The article of claim 72, wherein the longitudinal section, a ratio of the length of the section to a longest width is greater than 100:1.

76. The article of claim 72, wherein the longitudinal section, a ratio of the length of the section to a longest width is greater than 1000:1.

77. The article of claim 1, wherein the semiconductor comprises a single crystal.

78. The article of claim 1, wherein the semiconductor is part of a device.

79. The article of claim 1, wherein the semiconductor is n-doped.

80. The article of claim 1, wherein the semiconductor is p-doped.

81. The article of claim 1, wherein the semiconductor is magnetic.

82. The article of claim 81, wherein the semiconductor comprises a dopant making the semiconductor magnetic.

83. The article of claim 81, wherein the semiconductor is ferromagnetic.

84. The article of claim 83, wherein the semiconductor comprises a dopant that makes the semiconductor ferromagnetic.

85. The article of claim 84, wherein the semiconductor comprises manganese.

86. A device comprising an array of memory elements having a density of at least 10^{12} bytes/cm^2, wherein at least one memory element comprises the article of claim 1.

87. The device of claim 86, wherein the array has a density of at least 5×10^{12} bytes/cm^2.

88. The article of claim 1, wherein a nanoparticle is immobilized relative to the semiconductor.

89. The article of claim 88, wherein the nanoparticle comprises gold.

90. The article of claim 88, wherein the nanoparticle comprises gallium.

91. The article of claim 88, wherein the nanoparticle comprises nitrogen.

92. The article of claim 88, wherein the nanoparticle comprises iron.

93. The article of claim 88, wherein the nanoparticle is catalytic.

94. The article of claim 88, wherein the nanoparticle is faceted.

95. A device including a memory element comprising the article of claim 1.

96. The device of claim 95, wherein the memory element has a volume of less than 314 μm^3.

97. The device of claim 95, wherein the memory element is electronically switchable between a first readable state and a second readable state electronically distinguishable from the first readable state.

98. A device comprising an array of doped semiconductors, at least one of the semiconductors being the semiconductor of claim 1.

99. The device of claim 98, wherein the array is a crossed array.

100. The device of claim 99, wherein at least one semiconductor is in contact with another semiconductor of a different conductivity type.

101. The device of claim 99, wherein at least one semiconductor is in contact with another semiconductor of a same conductivity type.

102. The device of claim 99, wherein the device is configured to have a low turn-on voltage.

103. The device of claim 98, wherein the device is a memory element.

104. The device of claim 98, wherein the device is a logic gate.

105. The device of claim 98, wherein the device is a field effect transistor.

106. The device of claim 98, wherein the device is computational device.

107. The device of claim 98, wherein at least one of the doped semiconductors comprises a single crystal.

108. The device of claim 98, wherein at least one of the doped semiconductors is an elongated and bulk-doped semiconductor that, at any point along its longitudinal axis, has a largest cross-section dimension less than 500 nanometers.

109. The device of claim 98, wherein the device is configured to have a high turn-on voltage.

110. A computational device comprising the article of claim 1.

111. The computational device of claim 110, wherein the article comprising a semiconductor comprising a single crystal.

112. The computational device of claim 110, wherein the semiconductor is an elongated and bulk-doped semiconductor that, at any point along its longitudinal axis, has a largest cross-sectional dimension less than 500 nanometers.

113. The computational device of claim 110, wherein the computational device is a half-adder.

114. The article of claim 1, wherein the semiconductor comprises a first region having a composition and a second region having a composition different from the composition of the first region.

115. The article of claim 1, wherein the first region surrounds at least a portion of the second region.

116. The article of claim 1, wherein the semiconductor comprises a longitudinal axis, the first region positioned longitudinally of the second region.

117. The article of claim 1, wherein the free-standing nanoscopic wire comprises an n-type semiconductor and a p-type semiconductor.

118. An electrical component having the article of claim 1, the electrical component selected from the group consisting of a Schottky diode, a photodiode, a light emission source, a single photon emitter, a photoluminescent device, an electroluminescent device, a field-effect transistor, a bipolar junction transistor, a single-electron transistor, a rectifier, an inverter, a complimentary inverter, a photodetector, a p-n solar cell, a single photon detector, a tunnel diode, a light sensing device, a gate, an AND gate, a NAND gate, an OR gate, an XOR gate, a NOR gate, a latch, a flip-flop, a register, a switch, a clock circuit, a static memory device, a dynamic memory device, a programmable circuit, an amplifier, an analog circuit, an active transistor, a mixed signal device, and a signal processing circuit.

119. A diode having the article of claim 1.

120. The device of claim 119, wherein the diode is a light-emitting diode.

121. The device of claim 120, wherein the article comprises more than one light-producing region.

122. The device of claim 120, wherein the article is able to emit at more than one wavelength.

123. The diode of claim 120, wherein the diode has an emission wavelength determined by a dimension of a p/n junction between two doped nanowires.

124. The article of claim 1, wherein the semiconductor comprises a longitudinal axis and at least two regions differing in composition along the longitudinal axis.

125. The article of claim 1, wherein the at least two regions differ in concentration.

126. The article of claim 1, wherein the at least two regions differ in dopant.

127. The article of claim 1, wherein the semiconductor has an aspect ratio of at least about 100:1.

128. The article of claim 1, wherein the semiconductor is a nanoscopic wire.

129. The article of claim 1, wherein the semiconductor is a nanowire.

130. The article of claim 1, wherein the semiconductor is a nanotube.

131. An elongated and bulk-doped semiconductor that, at any point along its longitudinal axis, has a largest cross-sectional dimension less than 500 nanometers.

132. A method comprising:

(A) doping a semiconductor during growth of the semiconductor.

133. The method of claim 132, comprising fabricating a device including the semiconductor and at least one other component, comprising attaching the semiconductor to the at least one other component.

134. The method of claim 132, wherein the semiconductor is at least one of the following: a single crystal, an elongated and bulk-doped semiconductor that, at any point along its longitudinal axis, has a largest cross-sectional dimension less than 500 nanometers, and a free-standing and bulk-doped semiconductor with at least one portion having a smallest width of less than 500 nanometers.

135. The method of claim 132, further comprising:

(B) adding one or more other materials to a surface of the doped semiconductor.

136. The method of claim 135, wherein act (B) comprises forming a shell around the doped semiconductor.

137. The method of claim 132, wherein act (A) comprises:

controlling an extent of the doping.

138. The method of claim 132, wherein act (A) comprises growing the doped semiconductor by applying energy to a collection of molecules, the collection of molecules comprising molecules of the semiconductor and molecules of a dopant.

139. The method of claim 138, wherein act (A) comprises:

controlling an extent of the doping.

140. The method of claim 139, wherein the act of controlling doping comprises controlling a ratio of an amount of the semiconductor molecules to an amount of the dopant molecules.

141. The method of claim 139, wherein act (A) further comprises:

vaporizing the molecules using a laser to form vaporized molecules.

142. The method of claim 141, wherein act (A) further comprises:

growing the semiconductor from the vaporized molecules.

143. The method of claim 141, wherein act (A) further comprises:

condensing the vaporized molecules into a liquid cluster.

144. The method of claim 142, wherein act (A) further comprises:

growing the semiconductor from the liquid cluster.

145. The method of claim 141, wherein act (A) is performed using laser-assisted catalytic growth.

146. The method of claim 138, wherein the collection of molecules comprises a cluster of molecules of a catalyst material.

147. The method of claim 146, wherein act (A) comprises:

controlling a width of the semiconductor.

148. The method of claim 147, wherein controlling the width of the semiconductor comprises:

controlling a width of the catalyst cluster.

149. The method of claim 132, wherein act (A) further comprises:

performing chemical vapor deposition on at least the molecules.

150. The method of claim 132, wherein the grown semiconductor has at least one portion having a smallest width of less than 20 nanometers.

151. The method of claim 150, wherein the grown semiconductor has at least one portion having a smallest width of less than 10 nanometers.

152. The method of claim 150, wherein the grown semiconductor has at least one portion having a smallest width of less than 5 nanometers.

153. The method of claim 132, wherein the grown semiconductor is magnetic.

154. The method of claim 153, wherein act (A) comprises:

doping the semiconductor with a material that makes the grown semiconductor magnetic.

155. The method of claim 132, wherein the grown semiconductor is ferromagnetic.

156. The method of claim 155, act (A) comprises:

doping the semiconductor with a material that makes the grown semiconductor ferromagnetic.

157. The method of claim 156, wherein act (A) comprises:

doping the semiconductor with manganese.

158. The method of claim 132, comprising:

doping the semiconductor with a first dopant while growing the semiconductor; and

thereafter doping the semiconductor with a second dopant different from the first dopant.

159. The method of claim 158, further comprising attaching the semiconductor to at least one other component.

160. The method of claim 158, further comprising doping the semiconductor with a second dopant different from the first dopant.

161. The method of claim 132, wherein act (A) comprises doping a semiconductor with a dopant at a first concentration.

162. The method of claim 161, further comprising attaching the semiconductor to at least one other component.

163. The method of claim 161, further comprising doping the semiconductor at a second concentration different from the first concentration.

164. The method of claim 132, wherein act (A) comprises doping the semiconductor to from a nanoscale wire having a first region having a composition and a second region having a composition different from the first composition.

165. The method of claim 132, wherein act (A) comprises growing the semiconductor to form a grown semiconductor comprising a first bulk-doped region having a composition and a second bulk-doped region having a composition different from the composition of the first region.

166. A device comprising:

a semiconductor comprising a longitudinal axis, at least two regions differing in composition along the longitudinal axis, and a boundary between the regions, the semiconductor having a maximum dimension at the boundary of no more than about 100 nm.

167. The device of claim 166, wherein the maximum diameter at the boundary is no more than about 20 nm.

168. The device of claim 167, wherein the maximum diameter at the boundary is about 10 nm.

169. The device of claim 166, wherein the semiconductor is nanoscopic.

170. The device of claim 166, wherein the semiconductor is a nanoscopic wire.

171. The device of claim 166, wherein the semiconductor is a nanowire.

172. The device of claim 166, wherein the semiconductor is a nanotube.

173. The device of claim 166, wherein at least one of the at least two regions is bulk-doped.

174. The device of claim 166, wherein at least one of the at least two regions comprises a p-type dopant.

175. The device of claim 166, wherein at least one of the at least two regions comprises an n-type dopant.

176. The device of claim 166, wherein the semiconductor is free-standing.

177. The device of claim 166, wherein the semiconductor comprises at least one shell.

178. The device of claim 166, wherein the semiconductor comprises a functional moiety.

179. The device of claim 166, wherein the semiconductor comprises a reaction entity.

180. The device of claim 166, wherein the semiconductor has an aspect ratio of at least about 100:1.

181. The device of claim 166, wherein the device further comprises a nanoparticle immobilized relative to the semiconductor.

182. The device of claim 166, wherein the device is a diode.

183. The device of claim 166, wherein the device is a transistor.

184. The device of claim 166, wherein the device is a memory element.

185. The device of claim 166, wherein the device is able to emit light.

186. The device of claim 166, wherein the boundary is able to emit light.

187. The device of claim 166, wherein the device is able to emit light at more than one wavelength.

188. The device of claim 166, wherein the at least two regions comprise different dopants.

189. The device of claim 166, wherein the at least two regions comprise a dopant at a first concentration and a second concentration different from the first concentration.

190. The device of claim 166, wherein the semiconductor is able to bind to an analyte.

191. The device of claim 166, wherein the semiconductor comprises more than two boundaries, each boundary being between two regions differing in composition along the longitudinal axis.

192. The device of claim 191, wherein at least one of the more than two boundaries is able to emit light.

193. A device, comprising:

a free-standing wire comprising a first region having a composition and a second region having a composition different from the composition of the first region, wherein the first region has a smallest dimension that is less than about 100 nm and the second region has a smallest dimension that is less than about 100 nm.

194. The device of claim 193, wherein at least one of the first and the second region is bulk-doped.

195. The device of claim 193, wherein the wire comprises a semiconductor.

196. The device of claim 193, wherein the wire is a nanowire.

197. The device of claim 193, wherein the wire is as nanotube.

198. A device, comprising:

a free-standing bulk-doped nanoscopic material having a first region having a composition and a second region having a composition different from the composition of the first region, wherein at least one of the first region and the second region has an aspect ratio of at least about 100:1.

199. A device, comprising:

a free-standing bulk-doped semiconductor comprising a first region having a composition and a second region having a composition different from the composition of the first region, wherein at least one of the first and second region has a maximum dimension of less than about 100 nm.

200. A device, comprising:

a free-standing wire comprising a first region having a dopant and a second region having a dopant different from the dopant of the first region, the first region and the second region overlapping to form an overlap region having a composition that is a mixture of the dopants of the first and second regions, the composition of the overlap region comprising between about 10 vol% and about 90 vol% of the dopant of the first region with a complementary amount of the dopant of the second region, wherein the overlap region has a maximum dimension of less than about 100 nm.

201. A device, comprising:

a free-standing nanoscopic wire comprising a first region comprising a dopant at a first concentration and a second region comprising the dopant at a second concentration, wherein the second concentration is different from the first concentration.

202. A device, comprising:

a free-standing nanoscopic wire comprising a first semiconductor and a second semiconductor, at least one of the first semiconductor and the second semiconductor being a doped semiconductor, wherein a composition of the first semiconductor and a composition of the second semiconductor are different.

203. A device, comprising:

a free-standing nanoscopic wire comprising a first region having a first concentration of a semiconductor material and a second region having a second concentration of the semiconductor material, wherein the first concentration and the second concentration are different.

204. A device, comprising:

a free-standing nanoscopic wire comprising a first region having a first resistivity and a second region having a second resistivity different from the first resistivity.

205. A device, comprising:

a free-standing nanoscopic wire comprising a first region having a first band gap and a second region having a second band gap different from the first band gap.

206. A device, comprising:

a free-standing photoluminescent nanoscopic wire.

207. A device, comprising:

free-standing nanoscopic wire able to produce polarized light.

208. A device, comprising:

a nanoscopic wire able to produce light having a polarization ratio of at least about 0.60.

209. The device of claim 208, wherein the polarization ratio is at least about 0.84.

210. The device of claim 208, wherein the polarization ratio is at least about 0.91

211. The device of claim 208, wherein the polarization ratio is about 0.96

212. A device, comprising:

a photodetector having a responsivity of at least about 3000 A/W.

213. A device, comprising:

a photodetector having a detection speed of less than about 100 fs.

214. The device of claim 213, wherein the detection speed is less than about 10 fs.

215. A device, comprising:

a nanoscopic wire comprising a first region having a composition and a second region having a composition different from the first region, the first region and the second region overlapping to form an overlap region having a composition that is a mixture of the compositions of the first and second regions, the composition of the overlap region comprising between about 10 vol% and about 90 vol% of the composition of the first region with a complementary amount of the composition of the second region, wherein the overlap region is able to emit light.

216. The device of claim 215, wherein the device comprises more than one overlap region.

217. A device, comprising:
a free-standing nanoscopic wire comprising a plurality of light-emitting regions.

218. A method, comprising:
growing a nanoscale semiconductor having a plurality of regions able to produce light.

219. A device, comprising:
a light-emitting diode comprising a nanoscale wire comprising a first region having a dopant and a second region having a dopant different from the dopant of the first region, the first region and the second region overlapping to form an overlap region having a composition that is a mixture of the dopants of the first and second regions, the composition of the overlap region comprising between about 10 vol% and about 90 vol% of the dopant of the first region with a complementary amount of the dopant of the second region, wherein the light-emitting diode has an emission wavelength determined by a dimension of the overlap region.

220. A device, comprising:
a nanoscale wire comprising a first region having a dopant and a second region having a dopant different from the dopant of the first region, the first region and the second region overlapping to form an overlap region having a composition that is a mixture of the dopants of the first and second regions, the composition of the overlap region comprising between about 10 vol% and about 90 vol% of the dopant of the first region with a complementary amount of the dopant of the second region.

221. A device, comprising:

a wire comprising a semiconductor, wherein the wire is able to emit light at a higher frequency than the semiconductor in a bulk state.

222. A device, comprising:

a uniformly photoluminescent nanoscopic wire.

223. An article comprising:

a nanoscopic wire and a functional moiety positioned relative to the nanoscopic wire such that an interaction involving the moiety causes a detectable change in a property of the nanoscopic wire.

224. The article of claim 223, wherein the functional moiety is able to bind to an analyte.

225. The article of claim 223, wherein the nanoscopic wire comprises a material selected from the group consisting of Si, GaN, AlN, InN, GaAs, AlAs, InAs, InP, GaP, SiC, CdSe, ZnSe, ZnTe, ZnO, SnO_2, and TiO_2.

226. The article of claim 223, wherein the nanoscopic wire has a diameter ranging from 0.5 nm to 200 nm.

227. The article of claim 223, wherein the nanoscopic wire has an aspect ratio of more than 2.

228. The article of claim 223, wherein the functional moiety is selected from the group consisting of -OH, -CHO, -COOH, $-SO_3H$, -CN, $-NH_2$, -SH, -COSH, COOR, a halide, and combinations thereof.

229. The article of claim 223, wherein the functional moiety is selected from the group consisting of $-CH_3$, a hydrazide, and an aldehyde.

230. The article of claim 223, wherein the functional group is light activatable.

231. The article of claim 223, wherein the functional group is selected from the group consisting of an aryl azide, a fluorinated aryl azide, and a benophenone.

232. The article of claim 223, wherein the functional moiety is selected from the group consisting of an amino acid, a protein, a nucleic acid, an antibody, an antigen, and an enzyme.

233. The article of claim 223, wherein the functional moiety comprises a polymer chain with a chain length less than the diameter of the nanoscopic wire.

234. The article of claim 233, wherein the polymer is selected from a group consisting of a polyamide, a polyester, a polyimide, a polyacrylic, and combinations thereof.

235. The article of claim 223, where the functional moiety comprises a thin coating covering the surface of the nanoscopic wire, the coating selected from the group consisting of a metal, a semiconductor, and an insulator.

236. The article as in claim 235, wherein the coating is selected from the group consisting of a metallic element, an oxide, a sulfide, a nitride, a selenide, a polymer, and a polymer gel.

237. The article of claim 223, wherein the nanoscopic wire is a nanowire.

238. The article of claim 223, wherein the nanoscopic wire is a nanotube.

239. The article of claim 223, wherein the nanoscopic wire is free-standing.

240. The article of claim 223, wherein the nanoscopic wire is bulk-doped.

241. The article of claim 223, wherein the nanoscopic wire comprises a core and a shell.

242. The article of claim 223, wherein the nanoscopic wire comprises a longitudinal axis and two regions differing in composition along the longitudinal axis.

243. The article of claim 223, wherein the article further comprises a nanoparticle immobilized relative to the nanoscopic wire.

244. The article of claim 223, wherein the property includes light emission.

245. An article comprising:

a sample exposure region; and

a nanoscopic wire, at least a portion of which is addressable by a sample in the sample exposure region.

246. An article as in claim 245, further comprising a detector constructed and arranged to determine a property associated with the nanoscopic wire.

247. An article as in claim 245, wherein the sample exposure region comprises a microchannel.

248. An article as in claim 245, wherein the sample exposure region comprises a well.

249. An article as in claim 245, wherein the nanoscopic wire is a semiconductor.

250. An article as in claim 245, wherein the nanoscopic wire comprises silicon.

251. An article as in claim 245, wherein the nanoscopic wire comprises at least one p/n junction.

252. An article as in claim 245, wherein the nanoscopic wire is one of plurality of nanoscopic wires wherein each of the plurality of nanoscopic wires is doped with different concentrations of a dopant.

253. An article as in claim 245, wherein the nanoscopic wire is a carbon nanotube.

254. An article as in claim 245, wherein the nanoscopic wire is a nanotube.

255. An article as in claim 245, wherein the nanoscopic wire is a nanowire.

256. An article as in claim 245, wherein the nanoscopic wire is single-walled.

257. An article as in claim 245, wherein the nanoscopic wire is multi-walled.

258. An article as in claim 245, wherein the nanoscopic wire is unmodified.

259. An article as in claim 245, further comprising a reaction entity positioned relative to the nanoscopic wire such that an interaction between the reaction entity and an analyte in the sample causes a detectable change in a property of the nanoscopic wire.

260. An article as in claim 24, wherein the reaction entity comprises a binding partner of the analyte.

261. An article as in claim 260, wherein the binding partner is non-specific.

262. An article as in claim 260, wherein the binding partner is specific.

263. An article as in claim 260, wherein the binding partner comprises a chemical group on the nanoscopic wire surface selected from the group consisting of -OH, -CHO, -COOH, $-SO_3H$, -CN, $-NH_2$, -SH, -COSH, COOR, a halide, and combinations thereof.

264. An article as in claim 260, wherein the binding partner comprises a specific biomolecular receptor selected from the group consisting of DNA, fragments of DNA, an antibody, an antigen, an protein, and an enzyme.

265. An article as in claim 260, wherein the binding partner comprises a short polymer chain grafted on the nanoscopic wire surface, wherein the chain is selected from the group consisting of a polyamide, a polyester, a polyacrylic, and a polyimide.

266. An article as in claim 260, wherein the binding partner comprises a thin hydrogel layer coated on the surface of the nanoscopic wire.

267. An article as in claim 260, wherein the binding partner comprises a thin coating on the surface of nanoscopic wires, wherein the coating is selected form the group consisting of oxides, sulfides and selenides.

268. An article as in claim 245, wherein the nanoscopic wire comprises a chemical-gated nanoscopic wire field effect transistor wherein an electrical characteristic of the nanoscopic wire is sensitive to a chemical change on a surface of the nanoscopic wire.

269. An article as in claim 245, wherein the nanoscopic wire comprises a material selected from the group consisting of an electroluminescent material, a photoluminescent material, and a diode, wherein a light emitting property of the nanoscopic wire is sensitive to a chemical change on a surface of the nanoscopic wire.

270. An article as in claim 259, wherein the reaction entity is selected from the group consisting of a nucleic acid, an antibody, a sugar, a carbohydrate, and a protein.

271. An article as in claim 259, wherein the reaction entity comprises a catalyst.

272. An article as in claim 259, wherein the reaction entity comprises a quantum dot.

273. An article as in claim 259, wherein the reaction entity comprises a polymer.

274. An article as in claim 259, wherein the reaction entity is fastened to the nanoscopic wire.

275. An article as in claim 259, wherein the reaction entity is positioned within 5 nanometers of the nanoscopic wire.

276. An article as in claim 259, wherein the reaction entity is positioned within 3 nanometers of the nanoscopic wire.

277. An article as in claim 259, wherein the reaction entity is positioned within 1 nanometer of the nanoscopic wire.

278. An article as in claim 259, wherein the reaction entity is attached to the nanoscopic wire through a linker.

279. An article as in claim 259, wherein the reaction entity is attached to the nanoscopic wire directly.

280. An article as in claim 259 wherein the reaction entity is positioned relative to the nanoscopic wire such that it is electrically coupled to the nanoscopic wire wherein a detectable interaction between an analyte in the sample and the reaction entity causes a detectable change in an electrical property of the nanoscopic wire.

281. An article as in claim 247, wherein the microchannel has a minimum lateral dimension less than 1 mm.

282. The article of claim 247, wherein the microchannel has a minimum lateral dimension less than 0.5 mm.

283. The article of claim 247, wherein the microchannel has a minimum lateral dimension less than 200 microns.

284. An article as in claim 245, wherein the nanoscopic wire is one of a plurality of nanoscopic wires comprising a sensor.

285. An article as in claim 284, wherein each of the plurality of nanoscopic wires includes at least one portion positioned in the sample exposure region.

286. An article as in claim 284, wherein the plurality of nanoscopic wires comprises at least 10 nanoscopic wires.

287. An article as in claim 245, wherein the plurality of nanoscopic wires are arranged in parallel and addressed by a single pair of the electrodes.

288. An article as in claim 245, wherein the plurality of nanoscopic wires are arranged in parallel to each other and addressed individually by multiple pairs of electrodes.

289. An article as in claim 245, wherein the plurality of nanoscopic wires are different, each capable of detecting a different analyte.

290. An article as in claim 245, wherein the plurality of nanoscopic wires are oriented randomly.

291. An article as in claim 245, wherein the nanoscopic wire is positioned on the surface of a substrate.

292. An article as in claim 245, wherein the sample exposure region comprises a microchannel and the nanoscopic wire is suspended in the microchannel.

293. An article as in claim 245, where the article is one of a plurality of nanoscopic wire sensors in a sensor array formed on a surface of a substrate.

294. An article as in claim 293, wherein the substrate is selected from the group consisting of glass, silicon dioxide-coated silicon and a polymer.

295. An article as in claim 247, wherein the microchannel is dimensioned so as to produce a Reynolds number less than about 1 for a fluid comprising the sample.

296. An article as in claim 295, wherein the Reynolds number is less than about 0.01.

297. An article as in claim 245, constructed and arranged to receive a fluidic sample in the sample exposure region.

298. An article as in claim 245, wherein the sample comprises a gas stream.

299. An article as in claim 245, wherein the sample comprises a liquid.

300. An article as in claim 245, wherein the article comprises a plurality of nanoscopic wires and a plurality of reaction entities, at least some of which are positioned relative to the nanoscopic wires such that an interaction between the reaction entity and an analyte causes a detectable change in a property of a nanoscopic wire.

301. An article as in claim 300, wherein at least one reaction entity is positioned within 100 nanometers of a nanoscopic wire.

302. An article as in claim 300, wherein at least one reaction entity is positioned within 50 nanometers of a nanoscopic wire.

303. An article as in claim 300, wherein at least one reaction entity is positioned within 10 nanometers of a nanoscopic wire.

304. An article as in claim 245, where in the sample exposure region is addressable by a biological sample.

305. An article as in claim 245, where the article forms sensing elements for a microneedle probe.

306. An article as in claim 305, wherein the microneedle is implantable into a living subject.

307. An article as in claim 305, wherein the article is a sensor capable of monitoring a physiological characteristic.

308. An article as in claim 305, wherein the article is capable of monitoring a plurality of physiological characteristics.

309. An article as in claim 305, wherein the article is capable of simultaneously monitoring a plurality of physiological characteristics.

310. An article as in claim 305, wherein the article is capable of determining at least one of oxygen concentration, carbon dioxide concentration, and glucose level in a subject.

311. An article as in claim 245, where the article forms sensing elements for an integrated dip-probe sensor.

312. An article as in claim 245, where the article forms sensing elements for a plug and play sensor array.

313. An article as in claim 246, wherein the article is capable of delivering a stimulus to the nanoscopic wire and the detector is constructed and arranged to determine a signal resulting from the stimulus.

314. An article as in claim 313, wherein the stimulus is selected from the group consisting of constant current/voltage, an alternating voltage, and electromagnetic radiation.

315. An article as in claim 246, wherein the detector is constructed and arranged to determine an electrical property associated with the nanoscopic wire.

316. An article as in claim 246, wherein the detector is constructed and arranged to determine a change in an electromagnetic property associated with a nanoscopic wire.

317. An article as in claim 246, where the detector is constructed and arranged to determine a change in a light emission property associated with the nanoscopic wire.

318. An article as in claim 245, further comprising a second nanoscopic wire, at least a portion of which is addressable by a sample in the sample exposure region.

319. An article as in claim 245, wherein the nanoscopic wire comprises a functional moiety.

320. An article as in claim 245, wherein the nanoscopic wire comprises at least one shell.

321. An article as in claim 245, wherein the nanoscopic wire is able to emit light.

322. An article as in claim 245, wherein the nanoscopic wire comprises a longitudinal axis and two regions differing in composition along the longitudinal axis.

323. A method comprising:

contacting a nanoscopic wire with a sample suspected of containing an analyte; and

determining a change in a property of the nanoscopic wire.

324. A method as in claim 323, comprising:

measuring the property of the nanoscopic wire;

contacting the nanoscopic wire with the sample; and

measuring a change in the property of the nanoscopic wire.

325. The method of claim 323, further comprising:

positioning the analyte relative to the nanoscopic wire such that a specific binding interaction between the analyte and the nanoscopic wire causes a detectable change in a property of the nanoscopic wire.

326. The method of claim 323, wherein the nanoscopic wire comprises a functional moiety.

327. The method of claim 325, wherein the analyte is positioned within 5 nanometers of the nanoscopic wire.

328. The method of claim 325, wherein the analyte is positioned within 2 nanometers of the nanoscopic wire.

329. The method of claim 323, wherein the analyte is fastened relative to the nanoscopic wire.

330. The method of claim 323, further comprising functionalizing at least a portion of the surface of the nanoscopic wire.

331. The method of claim 323, further comprising providing a fluid channel for contacting the nanoscopic wire with the sample.

332. The method of claim 323, further comprising providing a binding partner of the analyte positioned relative to the nanoscopic wire such that binding of the analyte to the binding partner causes a detectable change in a property of the nanoscopic wire.

333. The method of claim 332, wherein the analyte is positioned within 5 nm of the nanoscopic wire.

334. The method of claim 323, wherein the nanoscopic wire is single-walled.

335. The method of claim 323, wherein the nanoscopic wire comprises carbon.

336. The method of claim 323, wherein the nanoscopic wire comprises silicon.

337. The method of claim 323, wherein the nanoscopic wire is a nanowire.

338. The method of claim 323, wherein the nanoscopic wire is a nanotube.

339. The method of claim 323, wherein the nanoscopic wire comprises a functional moiety.

340. The method of claim 323, wherein the nanoscopic wire comprises at least one shell.

341. The method of claim 323, wherein the nanoscopic wire is able to emit light.

342. The method of claim 323, wherein the nanoscopic wire comprises a longitudinal axis and two regions differing in composition along the longitudinal axis.

343. The method of claim 323, wherein the property includes light emission.

344. The method of claim 323, wherein the sample is suspected of containing a second analyte, the method further comprising:

providing a second nanoscopic wire;

measuring a property of the second nanoscopic wire;

contacting the second nanoscopic wire with the second analyte; and

measuring a change in the property of the second nanoscopic wire.

345. The method of claim 323, comprising first measuring a property of the nanoscopic wire, then contacting the nanoscopic wire with the sample, then determining a change in a property associated with the nanoscopic wire.

346. A method comprising:

contacting a nanoscopic wire with a sample having a volume of less than about 10 microliters; and

measuring a change in a property of the nanoscopic resultant from the contact.

347. A method comprising:

contacting a nanoscopic wire with a sample suspected of containing an analyte; and

determining the presence or quantity of the analyte by measuring a change in a property of the nanoscopic wire resulting from the contact, wherein less than ten molecules of the analyte contribute to the change in the property detected.

348. The method of claim 347, wherein less than 5 molecules of the species contribute to the change in electrical property.

349. The method of claim 347, wherein one molecule of the species contributes to the change in electrical property detected.

350. A method of detecting an analyte, comprising:

contacting a nanoscopic wire with a sample; and

determining a property associated with the nanoscopic wire where a change in the property when the nanoscopic wire is contacted with the sample indicates the presence or quantity of the analyte in the sample.

351. A method comprising:

contacting an electrical conductor with a sample; and

determining the presence or quantity of an analyte in the sample by measuring a change in a property of the conductor resultant from the contact, wherein less than ten molecules of the analyte contribute to the a change in said property.

352. A device, comprising:

an article formed of a bulk-doped semiconductor material, the article able to emit light at a frequency lower than the frequency of light emission inherent to the bulk-doped semiconductor material.

353. The device of claim 352, wherein the semiconductor material is nanoscopic.

354. The device of claim 352, wherein the semiconductor material is a nanoscopic wire.

355. The device of claim 352, wherein the semiconductor material comprises at least one shell.

356. The device of claim 352, wherein the semiconductor material is a nanotube.

357. The device of claim 352, wherein the semiconductor material is a nanowire.

358. The device of claim 352, wherein the semiconductor material has an aspect ratio of at least about 100:1.

359. The device of claim 352, wherein the semiconductor material has a smallest dimension of less than about 200 nm.

360. The device of claim 352, wherein the semiconductor material has a smallest dimension of less than about 100 nm.

361. The device of claim 352, wherein the semiconductor material has a smallest dimension of less than about 20 nm.

362. The device of claim 352, wherein the semiconductor material has a smallest dimension of less than about 5 nm.

363. The device of claim 352, wherein the semiconductor material is n-doped.

364. The device of claim 352, wherein the semiconductor material is p-doped.

365. The device of claim 352, wherein the article is free-standing.

366. The device of claim 352, wherein the semiconductor material comprises a functional moiety.

367. The device of claim 352, wherein the semiconductor material comprises a reaction entity.

368. The device of claim 352, wherein the device is a diode.

369. The device of claim 352, wherein the device is a transistor.

370. The device of claim 352, wherein the device is a memory element.

371. The device of claim 352, wherein the device is able to emit light at more than one wavelength.

372. The device of claim 352, wherein the nanoscopic wire comprises a longitudinal axis and at least two regions differing in composition along the longitudinal axis.

373. The device of claim 372, wherein the at least two regions comprise different dopants.

374. The device of claim 372, wherein the at least two regions comprise a dopant at a first concentration and a second concentration different from the first concentration.

375. A method comprising:

causing the emission of light from a semiconductor wire at a frequency lower than 700 nm.

376. A method as in claim 375, wherein the frequency is lower than 650 nm.

377. A method as in claim 375, wherein the frequency is lower than 600 nm.

378. A method as in claim 375, wherein the frequency is lower than 550 nm.

379. A method as in claim 375, wherein the frequency is lower than 530 nm.

380. A method as in claim 375, comprising causing the emission of light from a p/n junction.

381. A method as in claim 380, wherein the semiconductor wire comprises a core and a shell that form the p/n junction.

382. A method as in claim 380, the semiconductor wire comprising a longitudinal axis and at least two regions differing in composition along the longitudinal axis, wherein a boundary between the two regions defines the p/n junction.

383. A method as in claim 375, wherein the semiconductor wire is nanoscopic.

384. A method as in claim 375, wherein the semiconductor wire is a nanowire.

385. A method as in claim 375, wherein the semiconductor wire is a nanotube.

386. A method as in claim 375, wherein at least a portion of the semiconductor wire is bulk-doped.

387. A method as in claim 375, wherein the semiconductor wire is free-standing.

388. A method as in claim 375, wherein the semiconductor wire comprises at least one shell.

389. A method as in claim 375, wherein the semiconductor wire comprises a functional moiety.

390. A method as in claim 375, wherein the semiconductor wire comprises a reaction entity.

391. A method as in claim 375, wherein the semiconductor wire is able to emit light at more than one wavelength.

392. A device comprising:

a memory element comprising a memory active element having a

volume of less than 314 μm^3, the active element switchable electronically between a first readable state and a second readable state electronically distinguishable from the first readable state.

393. A device, comprising:
a transistor having a smallest dimension that is less than about 100 nm.

394. The device of claim 393, wherein the transistor is a bipolar junction transistor.

395. The device of claim 393, wherein the transistor is a field effect transistor.

396. The device of claim 393, wherein the smallest dimension is less than about 20 nm.

397. The device of claim 393, wherein the smallest dimension is less than is about 10 nm.

398. The device of claim 393, wherein at least a portion of the transistor comprises a semiconductor.

399. The device of claim 393, wherein at least a portion of the transistor is bulk-doped.

400. The device of claim 393, wherein the transistor comprises a nanoscopic wire.

401. The device of claim 400, wherein the nanoscopic wire comprises at least one shell.

402. The device of claim 400, wherein the nanoscopic wire comprises a longitudinal axis and two regions differing in composition along the longitudinal axis.

403. The device of claim 393, wherein the transistor comprises a nanotube.

404. The device of claim 393, wherein the transistor comprises a nanowire.

405. The device of claim 393, wherein the transistor is free-standing.

406. The device of claim 393, wherein the transistor has an aspect ratio of at least about 100:1.

407. The device of claim 393, wherein the transistor comprises a pair of crossed wires.

408. A doped semiconductor comprising a single crystal.

409. The semiconductor of claim 408, wherein the semiconductor comprises:

a core comprising a first semiconductor; and

at least one shell surrounding at least a portion of the core, the at least one shell comprising a different material than the first semiconductor.

410. The semiconductor of claim 408, wherein the semiconductor is bulk-doped.

411. The semiconductor of claim 408, wherein the semiconductor is free-standing.

412. The semiconductor of claim 408, wherein the semiconductor comprises a portion having a width of less than 500 nanometers.

413. The semiconductor of claim 408, wherein the semiconductor is elongated.

414. The semiconductor of claim 408, wherein the semiconductor is part of a device.

415. The semiconductor of claim 408, wherein the semiconductor is n-doped.

416. The semiconductor of claim 408, wherein the semiconductor is p-doped.

417. An article comprising a doped semiconductor, at least a portion of which is made by the method of doping the semiconductor during growth of the semiconductor.

418. The semiconductor of claim 417, wherein the doped semiconductor was grown by applying energy to one or more molecules of the semiconductor.

419. The semiconductor of claim 417, wherein the doped semiconductor was grown by applying energy to one or more molecules of a dopant.

420. The semiconductor of claim 417, wherein the doped semiconductor was grown by applying energy to one or more molecules of the semiconductor and one or more molecules of a dopant.

421. The semiconductor of claim 417, wherein at least a portion of the semiconductor is bulk-doped.

422. The semiconductor of claim 417, wherein the semiconductor comprises a single crystal.

423. The semiconductor of claim 417, wherein at least a portion of the semiconductor is free-standing.

424. The semiconductor of claim 417, wherein at least a portion of the semiconductor comprises a portion having a width of less than 500 nanometers.

425. The semiconductor of claim 417, wherein the semiconductor is elongated.

426. The semiconductor of claim 417, wherein at least a portion of the semiconductor is n-doped.

427. The semiconductor of claim 417, wherein at least a portion of the semiconductor is p-doped.

428. The semiconductor of claim 417, wherein the semiconductor is nanoscopic.

429. The semiconductor of claim 417, wherein the semiconductor is a nanoscopic wire.

430. The semiconductor of claim 417, wherein the semiconductor is a nanowire.

431. The semiconductor of claim 417, wherein the semiconductor is a nanotube.

432. A sensor comprising:

at least one nanoscale wire; and

means for measuring a change in a property of the at least one nanoscale wire.

433. The sensor of claim 432, wherein the property is an electrical property.

434. The sensor of claim 432, further comprising a chemical or biological agent positioned relative to the nanoscopic wire such that a specific binding interaction between the chemical or biological agent and a binding partner thereof causes a detectable change in an electrical property of the nanoscopic wire.

435. The sensor of claim 434, wherein the chemical or biological agent is fastened to the nanoscopic wire.

436. The sensor of claim 434, wherein the nanoscopic wire is coated with a chemical or biological agent.

437. The sensor of claim 434, wherein the chemical or biological agent is positioned within 5 nanometers of the nanoscopic wire.

438. The sensor of claim 434, wherein the chemical or biological agent is positioned within 3 nanometers of the nanoscopic wire.

439. The sensor of claim 434, wherein the chemical or biological agent is positioned within 1 nanometer of the nanoscopic wire.

440. The sensor of claim 432, wherein the nanoscopic wire is single-walled.

441. The sensor of claim 432, wherein the nanoscopic wire is a carbon nanotube.

442. The sensor of claim 432, wherein the nanoscopic wire is a nanotube.

443. The sensor of claim 432, wherein the nanoscopic wire is silicon nanowire.

444. The sensor of claim 432, wherein the nanoscopic wire is a nanowire.

445. The sensor of claim 432, wherein the fluid channel is a microchannel.

446. The sensor of claim 445, wherein the microchannel has a minimum lateral dimension less than 1 mm.

447. The sensor of claim 445, wherein the microchannel has a minimum lateral dimension less than 0.5 mm.

448. The sensor of claim 432, wherein the microchannel has a minimum lateral dimension less than 200 microns.

449. The sensor of claim 432, further comprising:

a second nanoscopic wire; and

a second chemical or biological agent positioned relative to the nanoscopic wire such that a specific binding interaction between the second chemical or biological agent and a second binding partner thereof causes a detectable change in an electrical property of the nanoscopic wire.

450. A bulk-doped semiconductor that is at least one of the following: a single crystal, an elongated and bulk-doped semiconductor that, at any point along its longitudinal axis, has a largest cross-sectional dimension less than 500 nanometers, and a free-standing and bulk-doped semiconductor with at least one portion having a smallest width of less than 500 nanometers, wherein a phenomena produced by a section of the bulk-doped semiconductor exhibits a quantum confinement caused by a dimension of the section.

451. The semiconductor of claim 450, wherein the semiconductor is elongated and the dimension is a width at any point along a longitudinal section of the semiconductor.

452. The semiconductor of claim 451, wherein the longitudinal section is capable of transporting electrical carriers without scattering.

453. The semiconductor of claim 451, wherein the longitudinal section is capable of transporting electrical carriers such that the electrical carriers pass through the longitudinal section ballistically.

454. The semiconductor of claim 451, wherein the longitudinal section is capable of transporting electrical carriers such that the electrical carriers pass through the longitudinal section coherently.

455. The semiconductor of claim 451, wherein the longitudinal section is capable of transporting electrical carriers such that the electrical carriers are spin-polarized.

456. The semiconductor of claim 455, wherein the longitudinal section is capable of transporting electrical carriers such that the spin-polarized electrical carriers pass through the longitudinal section without losing spin information.

457. The semiconductor of claim 451, wherein the longitudinal section is capable of emitting light in response to excitation, wherein a wavelength of the emitted light is related to the width.

458. The semiconductor of claim 457, wherein the wavelength of the emitted light is proportional to the width.

459. A bulk-doped semiconductor that exhibits coherent transport.

460. A bulk-doped semiconductor that exhibits ballistic transport.

461. A bulk-doped semiconductor that exhibits Luttinger liquid behavior.

462. A solution comprising one or more doped semiconductors, wherein at least one of the semiconductors is at least one of the following: a single crystal, an elongated and bulk-doped semiconductor that, at any point along its longitudinal axis, has a largest cross-sectional dimension less than 500 nanometers, and a free-standing and bulk-doped semiconductor with at least one portion having a smallest width of less than 500 nanometers.

463. A device comprising at least one doped semiconductor, wherein the at least one doped semiconductor is at least one of the following: a single crystal, an elongated and bulk-doped semiconductor that, at any point along its longitudinal axis, has a largest cross-sectional dimension less than 500 nanometers, and a free-standing and bulk-doped semiconductor with at least one portion having a smallest width of less than 500 nanometers.

464. The device of claim 463, wherein the device comprises at least two doped semiconductors, wherein both of the at least two doped semiconductors is at least one of the following: a single crystal, an elongated and bulk-doped semiconductor that, at any point along its longitudinal axis, has a largest cross-sectional dimension less than 500 nanometers, and a free-standing and bulk-doped semiconductor with at least one portion having a smallest width of less than 500 nanometers, and wherein a first of the at least two doped semiconductors exhibits quantum confinement and a second of the at least two doped semiconductor manipulates the quantum confinement of the first.

465. The device of claim 463, wherein the device comprises at least two doped semiconductor, wherein both of the at least two doped semiconductors is at least one of the following: a single crystal, an elongated and bulk-doped semiconductor that, at any point along its longitudinal axis, has a largest cross-sectional dimension less than 500 nanometers, and a free-standing and bulk-doped semiconductor with at least one portion having a smallest width of less than 500 nanometers.

466. The device of claim 464, wherein the at least two bulk-doped semiconductors are in physical contact with each other.

467. The device of claim 466, wherein a first of the at least two bulk-doped semiconductors is of a first conductivity type, and a second of the at least two bulk-doped semiconductors is of a second conductivity type.

468. The device of claim 467, wherein the first conductivity type is n-type, and the second type of conductivity type is p-type.

469. The device of claim 468, wherein the at least two bulk-doped semiconductors form a p/n junction.

470. The device of claim 463, wherein the at least one semiconductor is free-standing.

471. The device of claim 463, wherein the at least one semiconductor is elongated.

472. The device of claim 463, wherein the at least one semiconductor comprises a single crystal.

473. The device of claim 463, wherein the at least one semiconductor comprises:

a core comprising a first semiconductor; and

an exterior shell comprising a different material than the first semiconductor.

474. The device of claim 463, wherein the device comprises a switch.

475. The device of claim 463, wherein the device comprises a diode.

476. The device of claim 463, wherein the device comprises a light-emitting diode.

477. The device of claim 463, wherein the device comprises a tunnel diode.

478. The device of claim 463, wherein the device comprises a Schottky diode.

479. The device of claim 463, wherein the transistor comprises a bipolar junction transistor.

480. The device of claim 463, wherein the transistor comprises a field effect transistor.

481. The device of claim 463, wherein the device comprises an inverter.

482. The device of claim 481, wherein the inverter is a complimentary inverter.

483. The device of claim 463, wherein the device comprises an optical sensor.

484. The device of claim 463, wherein the device comprises a sensor for an analyte.

485. The device of claim 463, wherein the analyte is DNA.

486. The device of claim 463, wherein the device comprises a memory device.

487. The device of claim 486, wherein the memory device is a dynamic memory device.

488. The device of claim 486, wherein the memory device is a static memory device.

489. The device of claim 463, wherein the device comprises a laser.

490. The device of claim 463, wherein the device comprises a logic gate.

491. The device of claim 490, wherein the logic gate is an AND gate.

492. The device of claim 490, wherein the logic gate is a NAND gate.

493. The device of claim 490, wherein the logic gate is an EXCLUSIVE-AND gate.

494. The device of claim 490, wherein the logic gate is a OR gate.

495. The device of claim 490, wherein the logic gate is a NOR gate.

496. The device of claim 490, wherein the logic gate is an EXCLUSIVE-OR gate.

497. The device of claim 463, wherein the device comprises a latch.

498. The device of claim 463, wherein the device comprises a register.

499. The device of claim 463, wherein the device comprises clock circuitry.

500. The device of claim 463, wherein the device comprises a logic array.

501. The device of claim 463, wherein the device comprises a state machine.

502. The device of claim 463, wherein the device comprises a programmable circuit.

503. The device of claim 463, wherein the device comprises an amplifier.

504. The device of claim 463, wherein the device comprises a transformer.

505. The device of claim 463, wherein the device comprises a signal processor.

506. The device of claim 463, wherein the device comprises a digital circuit.

507. The device of claim 463, wherein the device comprises an analog circuit.

508. The device of claim 463, wherein the device comprises a light emission source.

509. The device of claim 508, wherein the light emission source emits light at a higher frequency than would the semiconductor if the semiconductor had a shortest width greater than the shortest width at any portion of the semiconductor.

510. The device of claim 463, wherein the device comprises a photoluminescent device.

511. The device of claim 463, wherein the device comprises an electroluminescent device.

512. The device of claim 463, wherein the device comprises a rectifier.

513. The device of claim 463, wherein the device comprises a photodiode.

514. The device of claim 463, wherein the device comprises a p-n solar cell.

515. The device of claim 463, wherein the device comprises a phototransistor.

516. The device of claim 463, wherein the device comprises a single-electron transistor.

517. The device of claim 463, wherein the device comprises a single photon emitter.

518. The device of claim 463, wherein the device comprises a single photon detector.

519. The device of claim 463, wherein the device comprises a spintronic device.

520. The device of claim 463, wherein the device comprises an ultra-sharp tip for atomic force microscope.

521. The device of claim 463, wherein the device comprises a scanning tunneling microscope.

522. The device of claim 463, wherein the device comprises a field emission device

523. The device of claim 463, wherein the device comprises a photoluminescence tag

524. The device of claim 463, wherein the device comprises a photovoltaic device

525. The device of claim 463, wherein the device comprises photonic band gap materials

526. The device of claim 463, wherein the device comprises a scanning near field optical microscope tips.

527. The device of claim 463, wherein the device comprises a circuit that has digital and analog components.

528. The device of claim 463, wherein the device comprises another semiconductor that is electrically coupled to the at least one bulk-doped semiconductor.

529. The device of claim 528, wherein the other semiconductor is a bulk-doped semiconductor comprising at least one portion having a smallest width of less than 500 nanometers.

530. The device of claim 463, wherein the device comprises another semiconductor that is optically coupled to the at least one bulk-doped semiconductor.

531. The device of claim 530, wherein the other semiconductor is a bulk-doped semiconductor comprising at least one portion having a smallest width of less than 500 nanometers.

532. The device of claim 463, wherein the device comprises another semiconductor that is magnetically coupled to the at least one bulk-doped semiconductor.

533. The device of claim 532, wherein the other semiconductor is a bulk-doped semiconductor comprising at least one portion having a smallest width of less than 500 nanometers.

534. The device of claim 463, wherein the device comprises another semiconductor that physically contacts the at least one bulk-doped semiconductor.

535. The device of claim 534, wherein the other semiconductor is at least one of the following: a single crystal, an elongated and bulk-doped semiconductor that, at any point along its longitudinal axis, has a largest cross-sectional dimension less than 500 nanometers, and a free-standing and bulk-doped semiconductor with at least one portion having a smallest width of less than 500 nanometers.

536. The device of claim 463, wherein the at least one semiconductor is coupled to an electrical contact.

537. The device of claim 463, wherein the at least one semiconductor is coupled to an optical contact.

538. The device of claim 463, wherein the at least one semiconductor is coupled to a magnetic contact.

539. The device of claim 463, wherein a conductivity of the at least one semiconductor is controllable in response to a signal.

540. The device of claim 539, wherein the conductivity of the at least one semiconductor is controllable to have any value within a range of values.

541. The device of claim 539, wherein the at least one semiconductor is switchable between two or more states.

542. The device of claim 541, wherein the at least one semiconductor is switchable between a conducting state and an insulating state by the signal.

543. The device of claim 541, wherein two or more states of the at least one semiconductor are maintainable without an applied signal.

544. The device of claim 539, wherein the conductivity of the at least one semiconductor is controllable in response to an electrical signal.

545. The device of claim 539, wherein the conductivity of the at least one semiconductor is controllable in response to an optical signal.

546. The device of claim 539, wherein the conductivity of the at least one semiconductor is controllable in response to a magnetic signal.

547. A device of claim 539, wherein the conductivity of the at least one semiconductor is controllable in response to a signal of a gate terminal.

548. The device of claim 547, wherein the gate terminal is not in physical contact with the at least one semiconductor.

549. The device of claim 463, wherein at least two of the semiconductors form an array, and at least one of the semiconductors in the array is at least one of the following: a single crystal, an elongated and bulk-doped semiconductor that, at any point along its longitudinal axis, has a largest cross-sectional dimension less than 500 nanometers, and a free-standing and bulk-doped semiconductor with at least one portion having a smallest width of less than 500 nanometers.

550. The device of claim 579, wherein the array is an ordered array.

551. The device of claim 549, wherein said array is not an ordered array.

552. The device of claim 463, wherein the device comprises two or more separate and interconnected circuits, at least one of the circuits not comprising a doped semiconductor that is at least one of the following: a single crystal, an elongated and bulk-doped semiconductor that, at any point along its longitudinal axis, has a largest cross-sectional dimension less than 500 nanometers, and a free-standing and bulk-doped semiconductor with at least one portion having a smallest width of less than 500 nanometers.

553. The device of claim 463, wherein the device is embodied on a chip having one or more pinouts

554. The device of claim 553, wherein the chip comprises separate and interconnected circuits, at least one of the circuits not comprising a doped semiconductor that is at least one of the following: a single crystal, an elongated and bulk-doped semiconductor that, at any point along its longitudinal axis, has a largest cross-sectional dimension less than 500 nanometers, and a free-standing and bulk-doped semiconductor with at least one portion having a smallest width of less than 500 nanometers.

555. A collection of reagents for growing a doped semiconductor that will be at least one of the following: a single crystal, an elongated and bulk-doped semiconductor that, at any point along its longitudinal axis, has a largest cross-sectional dimension less than 500 nanometers, and a free-standing and bulk-doped semiconductor with at least one portion having a smallest width of less than 500 nanometers that comprises at least one portion having a smallest width of less than 500 nanometers, wherein the collection comprises a semiconductor reagent and a dopant reagent.

556. A method of fabricating a device, comprising:

(A) contacting one or more semiconductors to a surface, wherein at least one of the semiconductors is at least one of the following: a single crystal, an elongated and bulk-doped semiconductor that, at any point along its longitudinal axis, has a largest cross-sectional dimension less than 500 nanometers, and a free-standing and bulk-doped semiconductor with at least one portion having a smallest width of less than 500 nanometers.

557. The method of claim 556, wherein the surface is a substrate.

558. The method of claim 556, further comprising:

(B) prior to act (A), growing at least one of the semiconductors by applying energy to molecules of a semiconductor and molecules of a dopant.

559. The method of claim 556, wherein act (A) comprises:

contacting a solution comprising the one or more semiconductors to the surface.

560. The method of claim 559, further comprising:

(B) aligning one or more of the semiconductors on the surface using an electric field.

561. The method of claim 560, wherein act (B) comprises:

generating an electric field between at least two electrodes; and

positioning one or more of the semiconductors between the electrodes.

562. The method of claim 559, further comprising:

(B) repeating act (A) with another solution comprising one or more other semiconductors, wherein at least one of the other semiconductor is at least one of the following: a single crystal, an elongated and bulk-doped semiconductor that, at any point along its longitudinal axis, has a largest cross-sectional dimension less than 500 nanometers, and a free-standing and bulk-doped semiconductor with at least one portion having a smallest width of less than 500 nanometers.

563. The method of claim 556, further comprising:

(B) conditioning the surface to attach the one or more contacted semiconductors to the surface.

564. The method of claim 563, wherein act (B) comprises:

forming channels on the surface.

565. The method of claim 563, wherein act (B) comprises:
patterning the surface.

566. The method of claim 556, further comprising:
(B) aligning one or more of the semiconductors on the surface using an electric field.

567. The method of claim 556, wherein act (B) comprises:
generating an electric field between at least two electrodes; and
positioning one or more of the semiconductors between the electrodes.

568. A method of generating light, comprising:
(A) applying energy to one or more semiconductors causing the one or more semiconductors to emit light, wherein at least one of the semiconductors is at least one of the following: a single crystal, an elongated and bulk-doped semiconductor that, at any point along its longitudinal axis, has a largest cross-sectional dimension less than 500 nanometers, and a free-standing and bulk-doped semiconductor with at least one portion having a smallest width of less than 500 nanometers.

569. The method of claim 568, wherein the semiconductor comprises a direct-band-gap semiconductor.

570. The method of claim 568, wherein act (A) comprises applying a voltage across a junction of two crossed semiconductors, each semiconductor having a smallest width of less than 500 nanometers.

571. The method of claim 570, wherein each semiconductor has a smallest width of less than 100 nanometers

572. The method of claim 568, further comprising:
(B) controlling a wavelength of the emitted light by controlling a

dimension of the at least one semiconductor having a smallest width of less than 100 nanometers.

573. The method of claim 572, wherein the semiconductor is elongated, and act (B) comprises:

controlling a width of the elongated semiconductor.

574. The method of claim 572, wherein:

the semiconductor has a property that a mass of the semiconductor emits light at a first wavelength if the mass has a minimum shortest dimension, and

the controlled dimension of the semiconductor is less than the minimum shortest dimension.

575. A method of assembling one or more elongated structures on a surface, wherein one or more of the elongated structures are at least one of the following: a single crystal, an elongated and bulk-doped semiconductor that, at any point along its longitudinal axis, has a largest cross-sectional dimension less than 500 nanometers, and a free-standing and bulk-doped semiconductor with at least one portion having a smallest width of less than 500 nanometers, and wherein the method comprises acts of:

(A) conditioning the surface with one or more functionalities that attract the one or more elongated structures to particular positions on the surface, and

(B) aligning the one or more elongated structures by attracting the one or more elongated structures to the particular positions using the one or more functionalities.

576. The method of claim 575, wherein act (A) comprises:

conditioning the surface with one or more molecules..

577. The method of claim 575, wherein act (A) comprises:

conditioning the surface with one or more charges.

578. The method of claim 575, wherein act (A) comprises:
conditioning the surface with one or more magnetos.

579. The method of claim 575, wherein act (A) comprises:
conditioning the surface with one or more light intensities.

580. The method of claim 575, wherein act (A) comprises:
conditioning the surface with one or more functionalities that attract the one or more elongated structures to particular positions on the surface using chemical force.

581. The method of claim 575, wherein act (A) comprises:
conditioning the surface with one or more functionalities that attract the one or more elongated structures to particular positions on the surface using optical force.

582. The method of claim 575, wherein act (A) comprises:
conditioning the surface with one or more functionalities that attract the one or more elongated structures to particular positions on the surface using electrostatic force.

583. The method of claim 575, wherein act (A) comprises:
conditioning the surface with one or more functionalities that attract the one or more elongated structures to particular positions on the surface using magnetic force.

584. A method of assembling a plurality of elongated structures on a surface, wherein one or more of the elongated structures are at least one of the following: a single crystal, an elongated and bulk-doped semiconductor that, at any point along its longitudinal axis, has a largest cross-sectional dimension less than 500 nanometers, and a free-standing and bulk-doped semiconductor with at least one portion having a smallest width of less than 500 nanometers, and

wherein the method comprises acts of:

(A) depositing the plurality of elongated structures onto the surface; and

(B) electrically charging the surface to produce electrostatic forces between two or more of the plurality of the elongated structures.

585. The method of claim 584, wherein the electrostatic forces cause the two or more elongated structures to align themselves.

586. The method of claim 585, wherein the electrostatic forces cause the two or more elongated structures to align themselves into one or more patterns.

587. The method of claim 586, wherein the one or more patterns comprise a parallel array.

588. A method of assembling a plurality of elongated structures on a surface, wherein one or more of the elongated structures are at least one of the following: a single crystal, an elongated and bulk-doped semiconductor that, at any point along its longitudinal axis, has a largest cross-sectional dimension less than 500 nanometers, and a free-standing and bulk-doped semiconductor with at least one portion having a smallest width of less than 500 nanometers, and wherein the method comprises acts of:

(A) dispersing the one or more elongated structures on a surface of a liquid phase to form a Langmuir-Blodgett film;

(B) compressing the Langmuir-Blodgett film; and

(C) transferring the compressed Langmuir-Blodgett film onto a surface

589. The method of claim 588, wherein the surface id the surface of a substrate.

590. A method of assembling a plurality of one or more elongated structures on a surface, wherein at least one of the elongated structures are at least one of the following: a single crystal, an elongated and bulk-doped semiconductor that, at any point along its longitudinal axis, has a largest cross-sectional dimension less

than 500 nanometers, and a free-standing and bulk-doped semiconductor with at least one portion having a smallest width of less than 500 nanometers, and wherein the method comprises acts of:

(A) dispersing the one or more elongated structures in a flexible matrix;

(B) stretching the flexible matrix in a direction to produce a shear force on the one or more elongated structures that causes the at least one elongated structure to align in the direction;

(C) removing the flexible matrix; and

(D) transferring the at least one aligned elongated structure to a surface.

591. The method of claim 590, wherein the direction is parallel to a plane of the surface.

592. The method of claim 590, wherein act (B) comprises:

stretching the flexible matrix with an electrically-induced force.

593. The method of claim 590, wherein act (B) comprises:

stretching the flexible matrix with an optically-induced force.

594. The method of claim 590, wherein act (B) comprises:

stretching the flexible matrix with a mechanically-induced force.

595. The method of claim 590, wherein act (B) comprises:

stretching the flexible matrix with a magnetically-induced force.

596. The method of claim 590, wherein the surface is a surface of a substrate.

597. The method of claim 590, wherein the flexible matrix is a polymer.

598. A system for growing a doped semiconductor, the system comprising:

means for providing a molecules of the semiconductor and molecules of a dopant; and

means for doping the molecules of the semiconductor with the molecules of the dopant during growth of the semiconductor to produce the doped semiconductor.

599. A system for assembling one or more elongated structures on a surface, the system comprising:

means for flowing a fluid that comprises the one or more elongated structures onto the surface; and

means for aligning the one or more elongated structures on the surface to form an array of the elongated structures.

600. A system for assembling one or more elongated structures on a surface, wherein one or more of the elongated structures are at least one of the following: is at least one of the following: a single crystal, an elongated and bulk-doped semiconductor that, at any point along its longitudinal axis, has a largest cross-sectional dimension less than 500 nanometers, and a free-standing and bulk-doped semiconductor with at least one portion having a smallest width of less than 500 nanometers, and wherein the system comprises:

means for conditioning the surface with one or more functionalities that attract the one or more elongated structures to particular positions on the surface, and

means for aligning the one or more elongated structures by attracting the one or more elongated structures to the particular positions using the one or more functionalities.

601. A system for assembling a plurality of elongated structures on a surface, wherein one or more of the elongated structures are at least one of the following: is at least one of the following: a single crystal, an elongated and bulk-doped semiconductor that, at any point along its longitudinal axis, has a largest cross-sectional dimension less than 500 nanometers, and a free-standing and bulk-doped semiconductor with at least one portion having a smallest width of less than 500 nanometers, and wherein the system comprises

means for depositing the plurality of elongated structures onto the surface; and

means for electrically charging the surface to produce electrostatic forces between two or more of the plurality of the elongated structures.

602. A system for assembling a plurality of elongated structures on a surface, wherein one or more of the elongated structures are at least one of the following: is at least one of the following: a single crystal, an elongated and bulk-doped semiconductor that, at any point along its longitudinal axis, has a largest cross-sectional dimension less than 500 nanometers, and a free-standing and bulk-doped semiconductor with at least one portion having a smallest width of less than 500 nanometers, and wherein the system comprises:

means for dispersing the one or more elongated structures on a surface of a liquid phase to form a Langmuir-Blodgett film;

means for compressing the Langmuir-Blodgett film; and

means for transferring the compressed Langmuir-Blodgett film onto a surface

603. A system for assembling a plurality of one or more elongated structures on a surface, wherein at least one of the elongated structures are at least one of the following: a single crystal, an elongated and bulk-doped semiconductor that, at any point along its longitudinal axis, has a largest cross-sectional dimension less than 500 nanometers, and a free-standing and bulk-doped semiconductor with at least one portion having a smallest width of less than 500 nanometers, and wherein the system comprises:

means for dispersing the one or more elongated structures in a flexible matrix;

means for stretching the flexible matrix in a direction to produce a shear force on the one or more elongated structures that causes the at least one elongated structure to align in the direction;

means for removing the flexible matrix; and

means for transferring the at least one aligned elongated structure to a surface.

604. An article comprising:

a sample cassette comprising a sample exposure region and a nanowire, at least a portion of which is addressable by a sample in the sample exposure region, wherein the sample cassette is operatively connectable to a detector apparatus able to determine a property associated with the nanowire.

605. A nanowire sensor device, comprising

a semiconductor nanowire having a first end in electrical contact with a conductor to form a source electrode, a second end in electrical contact with a conductor to form a drain electrode, and an exterior surface having an oxide formed thereon to form a gate electrode, and

a binding agent having specificity for a selected moiety and being bound to the exterior surface, whereby a voltage at the gate electrode varies in response to the binding of the moiety to the binding agent to provide a chemically gated field effect sensor device.

606. A analyte-gated field effect transistor having a predetermined current-voltage characteristic and adapted for use as a chemical or biological sensor, comprising:

(a) a substrate formed of a first insulating material;

(b) a source electrode disposed on the substrate;

(c) a drain electrode disposed on the substrate,

(d) a semiconductor nanowire disposed between the source and drain electrodes to form a field effect transistor having a predetermined current-voltage characteristic; and

(e) an analyte-specific binding agent disposed on a surface of the nanowire, wherein a binding event occurring between a target analyte and the binding agent causes a detectable change in the current-voltage characteristic of said field effect transistor.

607. The analyte-gated field effect transistor of claim 606, wherein the analyte is a chemical moiety.

608. The analyte-gated field effect transistor of claim 607, wherein the chemical moiety is a small organic compound.

609. The analyte-gated field effect transistor of claim 607, wherein the chemical moiety is an ion.

610. The analyte-gated field effect transistor of claim 607, wherein the analyte is a biological moiety.

611. The analyte-gated field effect transistor of claim 610, wherein the analyte is selected from the group consisting of proteins, nucleic acid, carbohydrates, lipids, and steroids.

612. An article comprising array of at least 100 of said analyte-gated field effect transistor of claim 606.

613. The article of claim 612, which is homogenous with respect to a population of analyte-specific binding agents associated with the article.

614. The article of claim 612, which is heterologous with respect to a population of analyte-specific binding agents associated with the article.

615. A field effect transistor comprising:

a conducting channel comprising a doped semiconductor having at least one portion having a smallest width of less then 500 nanometers; and

a gate electrode comprising an elongated material having at least one portion having a smallest width of less then 500 nanometers.

616. The field effect transistor of claim 615, wherein the elongated material is a doped semiconductor having a smallest width of less than 500 nanometers.

617. The field effect transistor of claim 615, wherein the doped semiconductor is a free-standing and bulk-doped semiconductor.

618. The field effect transistor of claim 615, wherein the doped semiconductor comprises a single crystal.

619. The field effect transistor of claim 615 wherein the doped semiconductor is an elongated and bulk-doped semiconductor that, at any point along its longitudinal axis, has a largest cross-sectional dimension less than 500 nanometers.

620. The field effect transistor of claim 615, wherein the doped semiconductor and the elongated material intersect.

621. The field effect transistor of claim 615, wherein a width of the field effect transistor is equal to the width of the doped semiconductor.

622. The field effect transistor of claim 615, wherein the doped semiconductor includes an oxide layer that functions as a gate dielectric for the field effect transistor.

623. The field effect transistor of claim 615, wherein an intersection of the doped semiconductor and the elongated material defines a length of the field effect transistor.

624. A logic gate, comprising a doped semiconductor having a smallest width of less than 500 nanometers.

625. The logic gate of claim 624, wherein the logic gate is configured to produce a voltage gain of 5 or greater.

626. The logic gate of claim 624, wherein the logic gate is an OR gate.

627. The logic gate of claim 624, wherein the logic gate is an AND gate.

628. The logic gate of claim 624, wherein the logic gate is an NOR gate.

629. The logic gate of claim 624, wherein the logic gate is an NOT gate.

630. The logic gate of claim 624, wherein the logic gate is an Exclusive OR gate.

631. The logic gate of claim 624, wherein the doped semiconductor is a free-standing and bulk-doped semiconductor.

632. The logic gate of claim 624, wherein the doped semiconductor comprises a single crystal.

633. The logic gate of claim 624, wherein the doped semiconductor is an elongated and bulk-doped semiconductor that, at any point along its longitudinal axis, has a largest cross-sectional dimension less than 500 nanometers.

634. A method of using a semiconductor, comprising:

providing a free-standing nanoscale semiconductor comprising a first region having a composition and a second region having a composition different from the composition of the first region; and

allowing an electrical current to flow through the doped semiconductor.

635. A method comprising:

exposing a conductor to a source of electromagnetic radiation; and

changing the electrical conductivity of the conductor by altering polarity

of the electromagnetic radiation in the absence of a grating between the source and the conductor.

636. A nanowire device including a semiconductor nanowire disposed proximate to an inductive material capable of establishing a field in the nanowire, which inductive material has at least two different electronic or mechanical states which able to differentially affect a property of the nanowire.

637. A device including a semiconductor disposed proximate to an inductive material capable of establishing a field in the semiconductor, the inductive material having at least two different states able to differentially affect a property of the semiconductor.

638. The device of claim 637, wherein the at least two different states are electronic states.

639. The device of claim 637, wherein the at least two different states are mechanical states.

640. The device of claim 637, wherein the property is conductivity of the semiconductor.

641. The device of claim 637, wherein the semiconductor is nanoscopic.

642. The device of claim 637, wherein the semiconductor is a nanoscopic wire.

643. The device of claim 637, wherein the semiconductor is a nanotube.

644. The device of claim 637, wherein the semiconductor is a nanowire.

645. The device of claim 637, wherein the semiconductor contacts the inductive material.

646. The device of claim 637, wherein the semiconductor is positioned within 5 nm of the inductive material.

647. The device of claim 637, wherein the inductive material comprises a functional moiety.

648. The device of claim 637, wherein the inductive material comprises a reaction entity.

649. The device of claim 637, wherein the semiconductor is free-standing.

650. The device of claim 637, wherein the semiconductor is bulk-doped.

651. The device of claim 637, wherein the inductive material comprises a second semiconductor.

652. The device of claim 637, wherein the inductive material comprises a nanoparticle.

653. The device of claim 637, wherein the inductive material comprises a second nanoscopic wire.

654. A semiconductor nanowire device, comprising:

a doped channel; and

an inductive material having at least two different electronic or mechanical states and being disposed proximate to the doped channel for inducing a field within the doped channel for effecting a flow of carriers.

655. A device, comprising:

a doped semiconductor; and

an inductive material having at least two different states, the inductive material being disposed proximate to the doped semiconductor.

656. The device of claim 655, wherein the at least two different states are electronic states.

657. The device of claim 655, wherein the at least two different states are mechanical states.

658. The device of claim 655, wherein the semiconductor is nanoscopic.

659. The device of claim 655, wherein the semiconductor is a nanoscopic wire.

660. The device of claim 655, wherein the semiconductor is a nanotube.

661. The device of claim 655, wherein the semiconductor is a nanowire.

662. The device of claim 655, wherein the semiconductor contacts the inductive material.

663. The device of claim 655, wherein the semiconductor is positioned within 5 nm of the inductive material.

664. The device of claim 655, wherein the inductive material comprises a functional moiety.

665. The device of claim 655, wherein the inductive material comprises a reaction entity.

666. The device of claim 655, wherein the semiconductor is free-standing.

667. The device of claim 655, wherein the semiconductor is bulk-doped.

668. The device of claim 655, wherein the inductive material comprises a second semiconductor.

669. The device of claim 655, wherein the inductive material comprises a nanoparticle.

670. The device of claim 655, wherein the inductive material comprises a second nanoscopic wire.

671. A semiconductor nanowire device, comprising:

a doped channel; and

an inductive material having at least two different electronic or mechanical states and being disposed proximate to the doped channel for inducing a field within the doped channel for affecting a flow of carriers.

672. A device, comprising:

a doped semiconductor; and

an inductive material having at least two different states, the inductive material being positioned so as to be able to affect a flow of carriers within the doped semiconductor.

673. The device of claim 672, wherein the at least two different states are electronic states.

674. The device of claim 672, wherein the at least two different states are mechanical states.

675. The device of claim 672, wherein the semiconductor is nanoscopic.

676. The device of claim 672, wherein the semiconductor is a nanoscopic wire.

677. The device of claim 672, wherein the semiconductor is a nanotube.

678. The device of claim 672, wherein the semiconductor is a nanowire.

679. The device of claim 672, wherein the inductive material comprises a functional moiety.

680. The device of claim 672, wherein the inductive material comprises a reaction entity.

681. The device of claim 672, wherein the semiconductor is free-standing.

682. The device of claim 672, wherein the semiconductor is bulk-doped.

683. The device of claim 672, wherein the inductive material comprises a second semiconductor.

684. The device of claim 672, wherein the inductive material comprises a nanoparticle.

685. The device of claim 672, wherein the inductive material comprises a second nanoscopic wire.

686. The article of claim 1, wherein the semiconductor is grown by laser-assisted catalytic growth from a nanoparticle.

687. The article of claim 1, wherein the nanoparticle comprises gold.

688. The method of claim 132, wherein act (A) is performed using laser-assisted catalytic growth.

689. The method of claim 136, wherein act (B) comprises forming at least two shells around the doped semiconductor.

690. The method of claim 132, further comprising the step of coating the semiconductor with a first material.

691. The method of claim 690, wherein the first material comprises a semiconductor.

692. The method of claim 690, further comprising the step of coating the semiconductor with a second material.

693. The method of claim 692, wherein the second material surrounds at least a portion of the first material.

694. The method of claim 132, wherein the semiconductor is grown from a nanoparticle.

695. The method of claim 694, wherein the nanoparticle is a gold nanoparticle.

696. A method, comprising:
growing a nanoscale wire having at least one shell from a nanoparticle.

697. The method of claim 696, wherein the nanoscale wire has at least two shells.

698. The method of claim 696, wherein the shell comprises a semiconductor.

699. The method of claim 696, wherein the nanoscale wire has a smallest width of less than 500 nm.

700. The method of claim 696, wherein the at least one shell has a thickness of less than about 5 nm.

701. The method of claim 696, wherein the nanoscale wire has an aspect ratio of at least 4:1.

702. The method of claim 696, wherein the nanoparticle is a gold nanoparticle.

703. The method of claim 696, wherein the nanoscale wire is a nanowire.

704. The method of claim 696, wherein the nanoscale wire is a nanotube.

705. The method of claim 696, wherein the shell is grown after the nanoscale wire is grown.

706. The method of claim 696, wherein the step of growing is performed using laser-assisted catalytic growth.

707. The method of claim 696, wherein the nanoscale wire is free-standing.

708. The method of claim 696, wherein the nanoscale wire is bulk-doped.

709. The method of claim 696, wherein the nanoscale wire is able to emit light.